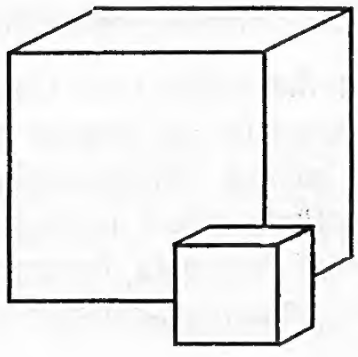
The Ballarat Naturalist

August 2003



Salt (NaCl) — Crystals belong to the Cubic System

Salinity - Rethinking An Old Problem

Dryland salinity in the Corangamite Area

Peter Dahlhaus

Peter studied Engineering Geology at RMIT and has worked for the Geological Survey and the Board of Works. Currently he runs his own Environmental Geology consultancy and lectures in the Geology Department at Ballarat University. He is completing a Ph.D. on dryland salinity.

Salinity occurs naturally in the landscape—primary salinity—such as Lake Eyre; secondary salinity refers to the salinisation of land and water resources due to human activities. In areas of dryland agriculture (i.e. non-irrigated agriculture) dryland salinity occurs.

In 2000 a National Land and Water Resources Audit was carried out, with predictions for Australia, and for Victoria for 2050; the north and west of Victoria was the worst affected. As a result a National Action Plan for Salinity and Water Quality 2001-2007 was established with a budget of $1.4 billion. The problem of salinity is dealt with by the Catchment Management Authorities; in Peter's study area this is primarily the Corangamite CMA and to some extent the Glenelg-Hopkins CMA. Six of the ten Victorian CMAs are receiving $304 million.

The Corangamite area extends from the Gt. Divide near Ballarat to Geelong, the Otways and Curdies Inlet. It includes Lakes Murdeduke, Connewarre and Corangamite with Ramsar Wetlands status. Dryland salinity occurs principally on the Western Plains area of basalt and adjacent rocks; its geology is very different from the Murray basin and therefore its hydrology has its own character, with the resulting unique salinity response.

The Plains contain a flat, shallow but extensive aquifer; rainfall varies from 400mm east of the Brisbane Ranges to 2000mm in the Otway Ranges. Rates of evaporation are around 1150mm-1200mm in the Plains. Areas of least rainfall have the greatest evaporation rates, thus compounding the shortage of effective rainfall.

Within the region Lake Connewarre is an example of primary salinity and is an asset recognised by its Ramsar status; any "freshening up" of this water would threaten wader habitat. The Inverleigh, Werneth and Mt. Mercer areas are examples of secondary salinity where no vegetation grows - "scalds". Other affected areas include the Bellarine Peninsula, Invermay and Pittong. Salinity becomes an urban problem in areas like Invermay, causing structural problems in buildings and roads.

A map of risk assessment indicated that 48% of land could be lost by 2050 in a worst case scenario. The traditional concept (developed in W.A.) that land clearing caused rising water tables to deposit salt into the evaporation zone near the soil surface is not necessarily appropriate for this Western Plains area. Peter conducted studies in 3 areas of varying geology and land use to find an appropriate model of salinisation.

1. Heytesbury: 100,000 acres were cleared in the 1960s; the incidence of salinity and landslides rose rapidly as a result of the hydraulic characteristics of the underlying geology. The aquifer is the Dilwyn Formation, a layer of sand sandwiched between the underlying Otway Group and the overlying Gellibrand Marl which is impermeable but saturated with water. Recharge of the Dilwyn beds results in upward pressure on the Marl and without the take-up of water by trees, landslides result, with a concentration of salinity at the base of the slip.

2. Moorabool River: this river provides Ballarat and Geelong with part of their water supplies. Salinity is measured in ECs (units of Electrical Conductivity) and Peter showed us graphs illustrating how salinity in the river had risen between 1976-2000 from 400 ECs to 600 Ecs, due partly to drought, but the trend nevertheless is upward. Last week it was 590 ECs; add 100 ECs caused by treatment, and the amount is rising. By 2010 salinity will exceed the Australian Drinking Water Standard of 500 ppm.

The catchment of the Lal Lal Reservoir on the Moorabool is on the basalt areas where there is no salinised land. So where is the source of the problem? A possibility is the over-extraction of groundwater for potato irrigation, resulting in reduced streamflow but higher salt content as the hydrologic balance changes. An increase in the number of farm dams also reduces flow. At Morrisons the EC is 750 but further downstream at Batesford it is 2000; water harvested in the Brisbane Ranges impacts on the lower Moorabool and Barwon Rivers. So water at Morrisons is already at the Drinking Water limits—downstream it must be diluted with fresher water to comply with the needs of industry and domestic use.

3. Lake Corangamite: Woady Yaloak Creek flows into the lake with EC readings of 1000-1300, yet water table levels are steady or falling slowly. The lake levels are very

low due to the current drought, resulting in the salinity of the lake being more than three times greater than the sea. The Ramsar status is being threatened. Peter's work has revealed that the problem may be due to the diversion of water across to the Barwon Catchment to maintain environmental flows. So here manipulation of water resources is the problem, not rising groundwater.

Many of these lakes contained eels when water levels were higher (supplying the Skipton factory) and some salinity was natural i.e. primary salinity. An appropriate ecology developed for this situation. Basalt areas were never heavily treed, and clearing was not a single event; land use was a patchwork of rotational uses. Therefore the major cause of the rising salinity is, once again , the management and diversion of surface water.

52% of the salinity was already there as a perfectly natural feature. We should change our ideas from thinking that all surface water should be fresh, and accept that some salinity is a part of the Australian environment with its own ecology.

Conclusion:

- Salinity problems are for more complex than the simplistic land clearing model. (see diagrams p.3 March 2002 newsletter)
- Salinity has doubled on farmland.
- Rising water tables are not always the cause.
- It then follows that planting trees on recharge areas is not necessarily going to be effective.
- Instead, rehabilitate the discharge areas.
- The management of surface and ground water has a huge impact on salinity.

NB. This presentation was by far the most sophisticated use of PowerPoint which the club has seen since the advent of the technology; not only was it specifically tailored for our club, but digitally created maps and graphs were seamlessly superimposed to show change over time; illustrations were sharp and clear, and there was no fumbling for files! Well done, Peter!

Excursion: Salinity in the Corangamite Region

Leader Peter Dahlhaus

Twenty members set out in our rented minibus on a day of winter sunshine ready to learn something of the salinity story first hand.

Peter initially "set the scene" on an embankment of Ordovician sediments in the picturesque grounds of the University of Ballarat. The Corangamite CMA is divided into four distinct geological regions; these are Central Highlands, Western District Plains, Otway Ranges and the Heytesbury. Peter believes salinity is not necessarily all from the time-honoured set of circumstances viz. clearing of vegetation leading

to rising water tables, but questions whether much of the Western District Plains were vegetated in the first place. Salinity in this zone is radically different from the type of salinity in the Murray Basin and Western Australia. Peter would divide the whole salinity situation into two parts i.e. primary and secondary (see lecture transcription). Ecology and landscape history are important in the salinity story. Areas of salinity are associated with differences in geology.

We stopped briefly at Hardie Hill and viewed the ancient volcanic crater to the west—swampy soils in this type of landscape are highly organically based and presented the best farm land early on. Apparently in the Pliocene the sea came right up to locations where stand today Rokewood, Narmbool, Scotsburn and the margins of Ballarat—this accounts for latter day primary salinity as the sea receded.

On the Mt. Mercer-Dereel road we stopped at a low-lying location—Peter had talked to Bob Wylie, owner of Mt. Mercer station—apparently in the early days the location was full of sedges (water-loving plants). The sheep used to eat these first; water then rose to the surface with secondary salinity problems and now the vegetation is salt-tolerant species e.g. Sea Barley Grass, Buck's Horn Plantain.

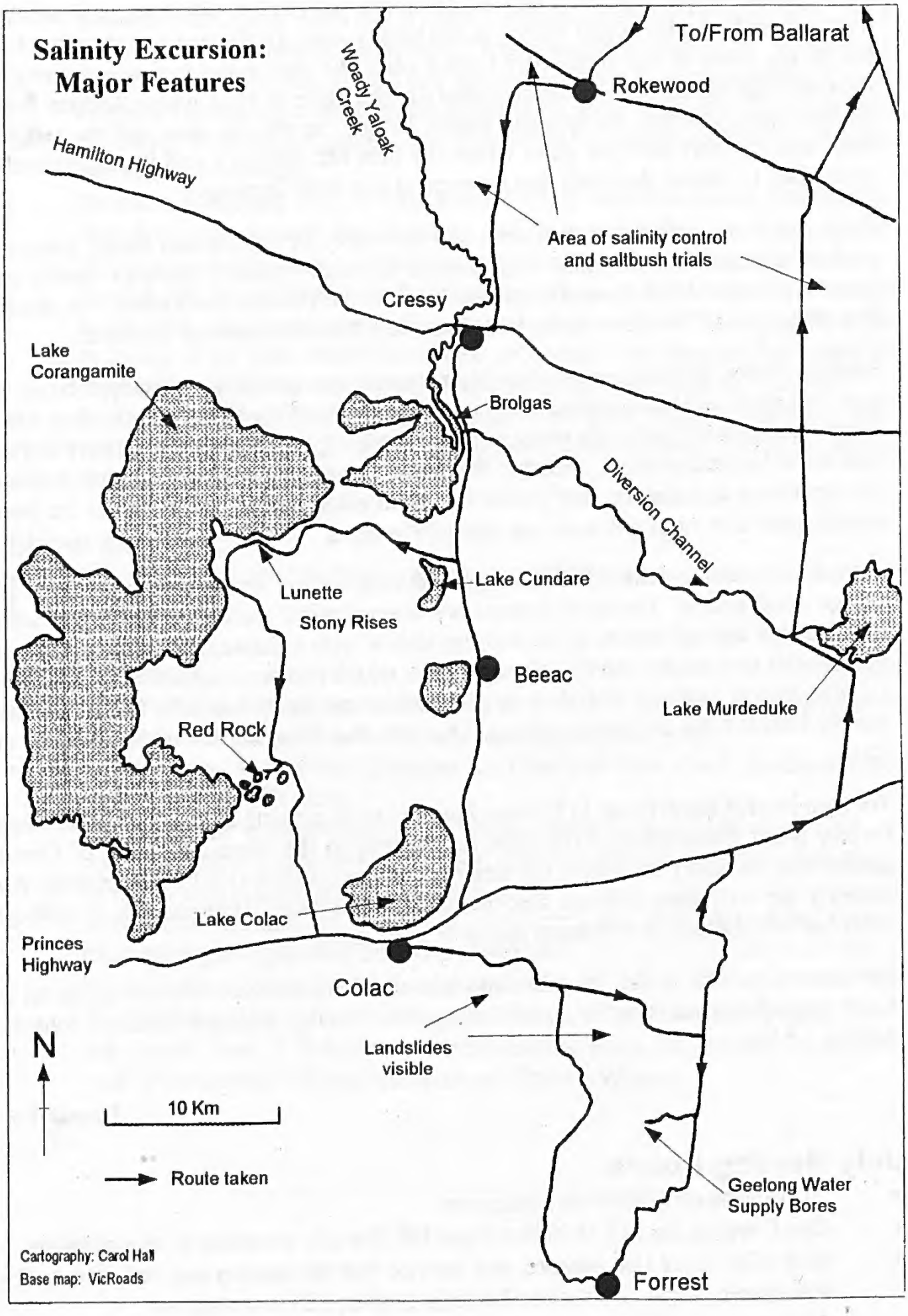
After passing through Rokewood Peter pointed out a paddock on the right where surface water had been used in a trial salinity control, and we noted that the road surface was constantly crumbling due to the effects of salt.

Next we crossed over the diversion channel which has been cut across to the Barwon Catchment from the Woady Yaloak Creek which enters Lake Corangamite. The diversion channel was installed in the 1950s after heavy rain in 1952 left rich farmland around the lake inundated for four years. Today we have the other extreme ("I love a sunburnt country.....of drought and flooding rains" - *My Country* by Dorothea MacKellar). Lake Corangamite is the lowest it's been for a long time with extreme salinity. Here five brolgas were seen.

This region we were passing through now—the Western District Plains—Peter postulated was always a bit saline. The academic land-clearing scenario is not convincing for at least some of this zone. (Matthew Flinders, the explorer apparently climbed the You Yangs in 1802 and saw the distant Mt. Buninyong over *treeless* plains).

Turning into Lake Corangamite Road we passed the hypersaline Lakes Cundare and nearby Beeac to the left. (Three brolgas were observed on Lake Cundare). We traversed the Stony Rises—magical country for rainfall: the groundwater is quite fresh. The road passed through a cutting made in the lunette which had formed on the east side of the lake when, during dry periods in the Pleistocene, westerly winds had blown sand from the lake floor into a crescent-shaped ridge. (Same process as that which formed the Walls of China on the eastern shore of Lake Mungo).

Atop the Red Rock Lookout—lunch time—the panorama included the shallow Lake


Salinity Excursion:
Major Features
To/From Ballarat
Rokewood
Woady Yaloak Creek
Hamilton Highway
Area of salinity control and saltbush trials
Cressy
Lake Corangamite
Brolgas
Diversion Channel
Lunette
Stony Rises
Lake Cundare
Beeac
Lake Murdeduke
Red Rock
Lake Colac
Princes Highway
Colac
N
Landslides visible
10 Km
Route taken
Geelong Water Supply Bores
Cartography: Carol Hall
Base map: VicRoads
Forrest

Corangamite to the west, with extinct volcanoes such as Mt. Elephant at Derinallum and Mounts Meningoort and Noorat in the background. To the east was the city of Colac on the shore of the freshwater Lake Colac. We descended to proceed along the Princes Highway through Colac (Incidentally the place in 1914 where Andrew Fisher pledged that Australia would stand beside Britain "to the last man and the last shilling" and 25 years later the place where the then Mr. Menzies said it was his melancholy duty to inform Australia that we were at war with Germany).

From Colac we took the Forrest road into the valley of the Barwon River; the crumpled earth landslides , the result of prolonged and heavy rainfall, are quite starkly seen in the Gellibrand Marl along the uplifted block of the Barwon Monocline. It is thought that with changed land use, slides have become shallower but more frequent.

Barwon Water, utilising every available resource, has installed originally 4 bores but now two more, at Gerangamete to tap into the aquifer of the Dilwyn Formation 600 m below, to augment Geelong's water supply. Overlying the sands of the Dilwyn Formation is the Gellibrand Marl, a muddy limestone forming an impermeable but saturated cap confining the aquifer, and producing an artesian basin - the water in the bores would spout 20m high if it were not captured in pipes.

A treatment plant to aerate the bore water and remove iron and arsenic in the form of a sludge stood nearby. The local farmers are worried about the land subsiding as water is taken out through bores. A monitoring station with a datalogger measured run-off and rainfall in a nearby mildly saline paddock which had been the site of a number of salinity control methods including re-afforestation on the distant hill. These trees had merely lowered the water-table directly beneath the trees but had no widespread effect.

We then headed north home to Ballarat but not before passing Lake Murdeduke where surface water flows *through* the lake, (in contrast to the "terminal" lakes of Corangamite and Cundare), the salt in the water becoming concentrated by evaporation. Apparently the wild man William Buckley caught eels here. Paddocks where saltbush trials had taken place were pointed out to us. (See map).

Destination Ballarat in the late afternoon and our intrepid driver John Gregurke let us know we had made a round trip of 300 Km. A fascinating day, and thanks to John for driving the bus.

Tony Johns.

July Meeting Points

- 30 members and visitors were welcomed.
- Club Campout, Sept 12-14 2003 at Stuart Mill. See July newsletter for revised details.
- BEN AGM: Carol Hall attended and reported that the meeting was well attended by enthusiastic people. She outlined the projects which BEN is working on.

- Creswick Golf Course: Carol Hall and John Gregurke attended a meeting with Forest Resort and Department of Sustainability and Environment staff. Draft development plan for leased land was studied and suggestions made to improve details of road locations, boundaries of development area and the native vegetation to be removed. Land swap is still to be organised - blocks at Kara Kara, Carlisle River and Grampians are under consideration.
- Donations to Appeals: That the Club donate $ 500 to each of Australian Bird Environment Foundation through Bird Observers Club of Australia, Trust for Nature - Ned's Corner Appeal. Moved John Mildren, seconded Pat Murphy. Carried unanimously.
- Bunkers Hill Gravel Pit: Belinda Taylor outlined the proposal to extract gravel from Bunkers Hill. This would destroy the vegetation on the site and adversely affect the hydrology of the area. Moved Gail Whyte, seconded Helen Burgess, that a letter of objection be sent to the City of Ballarat stating reasons for our objection. Carried.
- September meeting: Alan Kaufmann unable to be guest speaker. Members suggested the following ideas - David Clarke from Lexton Landcare, Ben Major, Ararat Biolink Project.

Show and Tell.

- Les Hanrahan: Wood Bluett fungi growing in mulch on garden.
- Carol Hall: Owl photographs.

Field Reports

- Carol Hall: Yellow-billed Spoonbill feeding at Durham Point, Lake Wendouree, was being followed by Great Egret which was capturing disturbed prey.
- Belinda Taylor: Pair of owls (probably Barn Owls) at Ross Creek. Golden-headed Cisticolas along Bell's Road.
- Ken McDonnell: Extensive patches of Shaggy Inkcap fungi at St George's Lake. In cool damp weather cormorants have been observed to shake water from their wings for 8-9 minutes to assist drying of feathers.
- John Mildren: Yellow-billed Spoonbill at Lake Wendouree. 35 Sulphur-crested Cockatoos muscling choughs away from food at Mt Helen.
- Helen Burgess: Variety of fungi in mulch-covered lawn.
- Kay Preston: Eastern Spinebill feeding in red salvia in Sturt Street back garden.
- Bob Curtain: Flock of 30 Sulphur-crested Cockatoos and 4 Long-billed Corellas feeding in grass between Gillies Street and North Gardens Wetland.

Calendar

August		
Fri. 1	Dr. Marie Keatley: *Phenological Monitoring and its Implications.*	
Sun. 3	Excursion: *Hepburn Regional Park* - Members.	
Tues. 26	Committee Meeting @ Carol's	7.30pm.
Wed. 27	Ballarat Observatory, Magpie St. 7.30pm $6.50/$5.50	
Sept.		
Fri. 5	Carol Hall: *A Natural History of Flinders Island.* (**NB** change of speaker).	
Sat. 6	Inaugural activity of *Orchid and Wildflower Study Group*: outing to Trentham property. For more details ph. Jennifer Johnson after 8pm	
Sun. 7	Excursion: *Ben Major* with John Gregurke.	

Supper Duty:	**August**	Volunteers needed
	September	Volunteers needed
	October	Stella Bedggood Lecture - Members.

Committee

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Secretary..... Mr. John Gregurke

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Miss Helen Burgess.....
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Mrs. Kay Preston.....

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Website: www.ballarat.yourguide.com.au Click on *Local Info.* Search *Environment.*

Meetings are held at the Ballarat Horticultural Centre, cnr. Gregory & Gillies Sts (VicRoads 254 F8) on the first Friday of the month at 7.30pm.

Excursions: Depart from Ballarat Market Place (formerly Creswick Plaza) Creswick Rd., Ballarat (VicRoads 255 M10) at 9.30 am unless otherwise specified.

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